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Determinants of Practitioners' Intention to Adopt Advanced Technology: A Conceptual Model for the Malaysian Eye Care Industry

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ABSTRACT: The Study develops and justifies an integrated framework to explain Malaysian eye care practitioners' intention to adopt advanced technologies in optometric practice. It motivated by a growing digital transformation in global eye care contrasted with comparatively slower and uneven adoption in Malaysia, particularly in private practices. This study synthesises technological, psychological, and contextual arguments to propose how digital tools such as OCT, retinal imaging, AI-assisted diagnostics, EHRs and tele-optometry can transform service quality, yet remain underutilised due to cost, capability, and policy–practice gaps. Drawing on the Technology Acceptance Model and the Theory of Planned Behaviour, supported by perspectives from UTAUT, Social Cognitive Theory, Ecological Modernisation Theory and the Technology–Organisation–Environment framework, the model posits that perceived usefulness, perceived ease of use, perceived behavioural control and subjective norm shape intention both directly and indirectly through attitude. Attitude is theorised as the mediating mechanism translating practitioners' beliefs, social pressures and perceived capabilities into adoption decisions. The paper further outlines a positivist, deductive, quantitative design using a cross-sectional survey of licensed optometrists and opticians in Malaysia, with validated Likert-scale measures and PLS-SEM for future empirical testing. Conceptually, the study advances technology-adoption research by explicitly modelling attitude as a mediator within an integrated TAM–TPB structure in an under-researched professional context. Practically, it offers a diagnostic lens for policymakers, professional bodies, technology providers and educators to design targeted incentives, training and support to strengthen digital readiness, address resistance, and accelerate the uptake of advanced technologies in Malaysia's optical sector.

KEYWORDS: Advanced Technologies, intention to adopt, Attitude TAM-TPB**,** optometric practice Malaysian eye care practitioners

1. INTRODUCTION

The intention to adopt advanced technology is a critical precursor to actual usage among health professionals and a decisive factor in shaping the digital transformation of healthcare services. In the optical sector, this intention determines whether eye care practitioners will integrate digital, automated, and intelligent systems that enhance diagnostic accuracy, workflow efficiency, and patient care. Globally, the optical industry is undergoing rapid technological change, with tools such as digital refraction systems, optical coherence tomography (OCT), retinal imaging, electronic health records (EHRs), artificial intelligence (AI)-assisted diagnostics, tele-optometry, and augmented/virtual reality increasingly redefining standards of practice (Ninomiya, 2022; Mack, 2019). These technologies represent a shift from traditional, manual processes towards interconnected, data-driven and precision-based eye care.

Malaysia's adoption of advanced optometric technologies remains slower than global trends despite growth in healthcare and eye care services (Azer, 2021; Ahmad Fairuz, 2022). Small, independent, and rural practices face barriers including high technology costs, limited financing, inadequate technical support, and weak institutional incentives, which restrict the transition to technology-enabled practice. These limitations create disparities in service quality and reduce the competitiveness of Malaysia's optical sector. Increasing population ageing and the prevalence of vision-related diseases such as glaucoma, diabetic retinopathy, and macular degeneration further intensify the need for advanced diagnostic systems like OCT and retinal imaging (Ninomiya, Lee, & Pitwon, 2022). However, limited adoption of EHRs and digital imaging continues to hinder clinical efficiency, continuity of care, and improved patient outcomes nationwide.

Although Malaysia's digital health policies emphasise technological integration, adoption within the optical sector remains limited due to inadequate training, subsidies, and digital literacy support for optometrists (Wahid, 2021; Kissner & Del Bino, 2023). This gap between policy and practice highlights the importance of understanding practitioners' perceptions of advanced technologies. Guided by the Technology Acceptance Model and Theory of Planned Behaviour, technology adoption intention is influenced by perceived usefulness, ease of use, subjective norm, perceived behavioural control, and attitude (George, 2019; Zainodin & Jantan, 2020). These factors shape practitioners' confidence, social expectations, and evaluations regarding technology integration in clinical practice.

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This underdevelopment in the literature is notable given the disruptive impact of the COVID-19 pandemic, which accelerated global uptake of digital health solutions, including tele-optometry and AI-supported diagnostics. While these tools have been widely recognised for enhancing safety, continuity of care, and operational efficiency, Malaysian eye care practitioners have not adopted them at comparable rates, signalling persistent hesitation or barriers despite evident benefits (Annamalah et al., 2024; Yahaya et al., 2023). The lack of context-specific research examining how pandemic-related pressures, changing patient expectations, and evolving professional norms shape practitioners' attitudes and intentions constitutes a significant gap. Understanding these dynamics is essential for designing effective interventions that address cost concerns, capability gaps, and resistance to change (Abd Aziz, 2010; Yusof, 2021).

For policymakers, unpacking the determinants of intention to adopt advanced technology among eye care practitioners is vital for crafting regulations, incentive schemes, and capacity-building initiatives that support digital transformation in the optical sector. For industry players and technology providers, such insights can inform product design, pricing models, training, and after-sales support that are better aligned with practitioners' perceived needs and constraints. For educational institutions, evidence on critical cognitive and behavioural drivers can guide the development of curricula and professional training that strengthen digital competencies and foster positive attitudes towards innovation. Ultimately, for patients and communities, improved understanding and targeted interventions can translate into earlier detection of eye conditions, higher-quality care, and more equitable access to advanced diagnostic and therapeutic services.

Against this backdrop, this study aims to develop and justify an integrated TAM–TPB framework that explains Malaysian eye care practitioners' intention to adopt advanced technologies in optometric practice. Specifically, it proposes that perceived usefulness, perceived ease of use, subjective norm, and perceived behavioural control influence intention both directly and indirectly through attitude. By theorising attitude as a central mediating mechanism, the study addresses a key gap in existing technology adoption research and offers a contextually grounded model for understanding and enhancing advanced technology adoption in Malaysia's optical sector.

2. LITERATURE REVIEW

2.1 Underpinning Theories

This study is underpinned by an integrated framework combining the Technology Acceptance Model (TAM) (Davis, 1989), the Theory of Planned Behavior (TPB) (Ajzen, 1991), and supporting perspectives from UTAUT, Social Cognitive Theory, Ecological Modernization Theory, and the Technology–Organisation–Environment (TOE) framework. Together, these theories provide a comprehensive explanation of how eye care practitioners in Malaysia form intentions to adopt advanced optical technologies.

TAM establishes the foundational cognitive evaluations that drive technology adoption, namely perceived usefulness (PU) and perceived ease of use (PEOU), which shape an individual's attitude toward a system. In optical practice, these constructs reflect practitioners' beliefs about whether advanced technologies enhance diagnostic accuracy, workflow efficiency, and clinical performance. When practitioners perceive that technologies such as digital refractors, OCT systems, or AI-driven diagnostic platforms are useful and easy to operate, a favourable attitude toward adoption is formed (Rafique et al., 2020; Binyamin et al., 2024).

TPB extends this evaluative process by introducing subjective norm (SN) and perceived behavioural control (PBC) as additional antecedents of attitude and intention. Subjective norm captures professional expectations from colleagues, industry bodies, and patients, all of which exert social pressure on practitioners to remain technologically updated (Kaur et al., 2021). PBC reflects the degree of confidence practitioners have in their skills, resources, training, and ability to integrate advanced technologies into routine practice (Wang et al., 2020). In optical clinics, where advanced tools require specialised knowledge, PBC becomes a critical predictor of both attitude and intention.

Supporting theories deepen this understanding. UTAUT reinforces the influence of social norms and facilitating conditions (Venkatesh et al., 2016). Social Cognitive Theory explains how observational learning and peer modelling enhance self-efficacy and adoption likelihood (Bandura, 2012). Ecological Modernization Theory highlights how technological progress yields economic and environmental improvements, making advanced optical technologies dual-benefit solutions (David, 2017). TOE and the Knowledge-Based View emphasise organisational readiness, external support, and the centrality of professional knowledge in shaping adoption decisions (Jeff, 2011).

2.2 Perceived Usefulness, Attitude, and Intention to Adopt

Perceived usefulness (PU) represents the degree to which practitioners believe that a technology enhances professional performance (Davis, 1989). Extensive evidence confirms that PU directly shapes attitudes toward technology adoption. Users who perceive significant clinical or operational benefits are more likely to develop favourable attitudes (Al-Emran et al., 2020; Abdullah & Ward, 2016). In clinical optical settings, PU reflects the expectation that technologies improve diagnostic precision and patient outcomes, thereby fostering positive evaluations of their adoption.

PU also directly predicts intention to adopt, as individuals generally commit to behaviours believed to yield beneficial outcomes (Venkatesh et al., 2016). This relationship is evident across healthcare, mobile health applications, and digital service systems, where perceived performance improvements motivate stronger adoption intentions (Oliveira et al., 2016). Thus, when eye care practitioners believe that advanced technologies such as OCT or automated refraction systems enhance practice efficiency, their intention to adopt strengthens.

Furthermore, attitude acts as the key psychological mechanism that converts perceived usefulness into behavioural intention. Studies consistently show that PU improves attitude, which subsequently increases intention to adopt (Li et al., 2021). In optical practice, a practitioner may recognise the clinical value of technology but still hesitate unless a favourable attitude is formed. Therefore, the following hypotheses are proposed:

H1: Perceived usefulness positively influences attitude among eye care practitioners.

H2: Perceived usefulness positively influences intention to adopt advanced technology.

H10: Attitude positively mediates the relationship between perceived usefulness and intention to adopt advanced technology.

2.3 Perceived Ease of Use, Attitude, and Intention to Adopt

Perceived ease of use (PEOU) reflects the degree to which practitioners believe that a technology is effortless to learn and operate. PEOU consistently enhances attitudes toward technology, as users are more likely to evaluate systems positively when they require minimal cognitive or

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physical effort (Zhou et al., 2020). In the optical sector, where technologies vary in complexity, perceptions of simplicity and intuitive design significantly strengthen positive attitudes.

PEOU also directly influences intention to adopt, especially in environments where practitioners value time efficiency and workflow integration (Wang et al., 2022). Studies across mobile banking, e-learning, digital health, and enterprise systems show that ease of use encourages behavioural intention. For eye care practitioners, intuitive digital imaging systems or user-friendly EHR interfaces reduce perceived barriers and elevate intention to adopt.

Crucially, attitude mediates the influence of PEOU on intention. When systems are easy to use, they create a positive evaluative response, which then increases willingness to adopt (Alalwan et al., 2017). This mediating effect is widely supported across healthcare, education, mobile commerce, and social platforms (Zhou et al., 2020). Thus, the following hypotheses are developed:

H3: Perceived ease of use positively influences attitude among eye care practitioners.

H4: Perceived ease of use positively influences intention to adopt advanced technology.

H11: Attitude positively mediates the relationship between perceived ease of use and intention to adopt advanced technology.

2.4 Perceived Behavioural Control, Attitude, and Intention to Adopt

Perceived behavioural control (PBC) reflects practitioners' confidence in their skills, resources, and ability to adopt technologies (Ajzen, 1991). When individuals believe they can successfully perform a behaviour, they develop more favourable attitudes toward it (Zhang et al., 2019). In optical practice, confidence in operating advanced devices supported by training, technical assistance, and financial readiness strengthens positive attitudes.

PBC also directly predicts intention, as individuals with greater perceived control exhibit stronger behavioural commitment (Tamtam et al., 2018; Wang et al., 2018). For eye care practitioners, perceptions of accessible training, technical infrastructure, or financing will heighten intention to integrate digital diagnostic systems into their workflow.

Moreover, PBC shapes intention indirectly through attitude. When practitioners feel empowered and capable, they form positive attitudes that motivate adoption (Chen et al., 2021). Evidence from healthcare, sustainability, education, and consumer contexts consistently demonstrates this mediating pathway. Thus, the following hypotheses are proposed:

H5: Perceived behavioural control positively influences attitude among eye care practitioners.

H6: Perceived behavioural control positively influences intention to adopt advanced technology.

H12: Attitude positively mediates the relationship between perceived behavioural control and intention to adopt advanced technology.

2.5 Subjective Norm, Attitude, and Intention to Adopt

Subjective norm (SN) refers to perceived social pressure from peers, professional associations, patients, and regulatory bodies to engage in a behaviour (Ajzen, 1991). In healthcare and optical practice, where professional alignment and peer reputation matter, subjective norm strongly shapes practitioners' attitudes toward technology adoption (Kaur et al., 2021). When influential colleagues endorse digital diagnostics or when professional bodies promote technological upgrading, practitioners develop favourable attitudes.

Subjective norm also directly predicts intention to adopt (Carter et al., 2020). In collectivist contexts such as Malaysia, social expectations and normative influence play a heightened role in shaping behavioural choices. Thus, when practitioners perceive strong social expectations to remain technologically competitive, intention to adopt increases.

Additionally, subjective norm influences intention indirectly through attitude. Studies show that when individuals perceive strong normative support, they develop favourable attitudes that translate into behavioural commitment (Venkatesh et al., 2016; Wang et al., 2020). This dynamic is observed across innovation adoption, sustainability behaviour, consumer decision-making, and social media usage. Consequently, the following hypotheses are formulated:

H7: Subjective norm positively influences attitude among eye care practitioners.

H8: Subjective norm positively influences intention to adopt advanced technology.

H13: Attitude positively mediates the relationship between subjective norm and intention to adopt advanced technology.

2.6 Attitude and Intention to Adopt Advanced Technology

Attitude represents practitioners' overall evaluative judgement toward using advanced technologies. Studies consistently demonstrate that positive attitudes toward technological systems significantly enhance intention to adopt (Davis et al., 2018; Zhao et al., 2022). In clinical environments, practitioners who believe that digital tools improve convenience, diagnostic ability, and patient care develop stronger intentions to integrate them into practice.

Beyond its direct predictive role, attitude also functions as a cognitive filter through which practitioners evaluate the personal and professional relevance of advanced technologies. When eye care practitioners perceive technological tools as compatible with their clinical values, workflow needs, and patient care priorities, their favourable attitude strengthens the internal motivation to adopt these innovations (Oliveira et al., 2016; Park et al., 2018). Research across healthcare and digital service environments reinforces that positive attitudes arise when users experience alignment between perceived benefits and their own professional identity, ultimately reinforcing intention (Alalwan et al., 2018). In optical practice, where technological advancement is closely tied to service quality and competitive positioning, a positive attitude reflects not only perceived utility but also confidence, trust, and perceived professional enhancement. As this attitudinal evaluation becomes more favourable, practitioners demonstrate stronger readiness to commit to adoption, confirming its central role in shaping intention.

H9: Attitude positively influences intention to adopt advanced technology among eye care practitioners.

2.7. Research Framework

The research framework integrates the core constructs of TAM and TPB to explain the behavioural mechanism through which Malaysian eye care practitioners form intentions to adopt advanced optical technologies. As illustrated in Figure 1 four cognitive and psychosocial determinants—perceived usefulness, perceived ease of use, perceived behavioural control, and subjective norm—are proposed to exert direct influences on attitude

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(H1, H3, H5, H7). This reflects the theoretical position that practitioners' evaluative judgments toward technology are shaped not only by their beliefs about its utility and ease of operation but also by their perceived capability and the social expectations surrounding its use. These same determinants also demonstrate direct pathways to intention to adopt (H2, H4, H6, H8), indicating that practitioners do not rely solely on attitudinal evaluations but also consider functional benefits, ease, confidence, and normative pressures when forming adoption intentions. The framework thus establishes attitude as a central psychological construct with its own direct effect on intention (H9), reaffirming the importance of positive evaluation in translating perceptions into behavioural commitment.

In addition to these direct pathways, the framework incorporates mediated relationships to capture the indirect effects of the four antecedents on intention via attitude (H10–H13). This conceptualisation recognises that advanced technology adoption is not driven solely by functional or social beliefs, but also by the emotional and evaluative responses practitioners form as they interpret these beliefs. The dotted lines in the model represent these mediating effects, illustrating how perceived usefulness, ease of use, perceived behavioural control, and subjective norms contribute to intention indirectly by shaping a favourable or unfavourable attitude. By combining both direct and indirect pathways, the research framework provides a comprehensive view of how cognitive beliefs, perceived capabilities, and social influences converge to shape practitioners' readiness to adopt advanced technology. This integrated structure therefore offers a theoretically robust explanation of technology adoption behaviour in the optical sector, recognising both the rational and affective mechanisms underlying practitioners' decision-making processes.

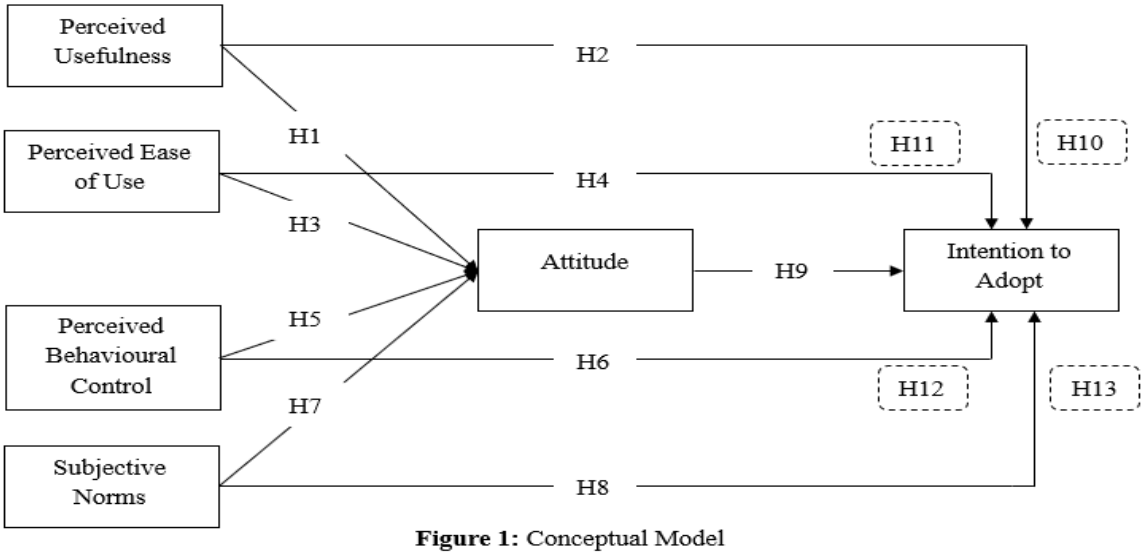


Figure 1: Conceptual Model

3. METHODOLOGY

This study proposes a positivist, deductive, quantitative design to empirically test the advanced technology adoption framework among eye care practitioners in Malaysia. Positivism assumes an objective reality that can be observed, measured, and analysed statistically, making it suitable for hypothesis-driven studies that seek generalisable explanations of behaviour (Saunders et al., 2019; Park et al., 2020). Guided by this paradigm, the study moves deductively from TAM–TPB theory toward testable hypotheses about perceived usefulness, perceived ease of use, perceived behavioural control, subjective norm, attitude and intention (Davis, 1989; Ajzen, 1991). A cross-sectional survey will be used to capture practitioners' current perceptions and intentions at a single point in time, enabling efficient testing of the proposed relationships and identification of prevailing adoption patterns in the optical sector (Creswell & Creswell, 2018; Institute for Work & Health, 2015).

A structured questionnaire is the primary data-collection instrument. Items are adopted and adapted from established scales in TAM and TPB research to ensure content validity and comparability with prior work (Clark & Watson, 2019). The instrument measures perceived usefulness, perceived ease of use, perceived behavioural control, subjective norms, attitude and intention to adopt, using five-point Likert scales anchored from "strongly disagree" to "strongly agree", which support reliable quantification and advanced statistical analysis such as factor analysis and SEM (Thakkar, 2020; Taherdoost, 2019). Questionnaire development follows a multi-stage process including expert review for face and content validity, pilot testing, and refinement. Domain experts in optometry and behavioural science evaluate item clarity and relevance, while content coverage is verified against the technology-adoption literature and theoretical definitions of each construct (Harper et al., 2016; Muthiah et al., 2024; Yusoff, 2019). A pilot study with eye care practitioners assesses reliability via Cronbach's alpha, ensuring internal consistency above recommended thresholds before the full survey is implemented (Hair et al., 2021).

The target population comprises licensed optometrists and opticians practising in Malaysia, particularly in the private sector where most advanced optical technologies are introduced and deployed. These practitioners are primary decision-makers regarding investments in digital diagnostic tools, automated refraction systems and AI-enabled platforms, making them an appropriate unit of analysis for individual-level adoption decisions (Association of Malaysian Optometrists, 2024; Medical Journal of Malaysia, 2023). The unit of analysis is therefore the individual eye care

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practitioner, regardless of whether they work in private clinics, hospitals or retail optical outlets, reflecting the theoretical focus on personal beliefs, attitudes and intentions rather than organisational policies. A purposive sampling strategy is proposed to ensure inclusion of practitioners who meet criteria such as being licensed, having at least one year of practice, and currently using or considering advanced optical technologies (Ahmad & Wilkins, 2024). This non-probability technique prioritises relevance and domain expertise over randomness, which is crucial in specialised technology-adoption research.

Sample size will be guided by **Nunnally's (1978) 10:1 rule**, requiring at least ten respondents per measurement item. With 27 items, a minimum of 270 completed responses is targeted to secure stable parameter estimates, adequate reliability and valid factor structures for multivariate analysis. Meeting or exceeding this threshold strengthens the robustness of regression and SEM results by reducing the risk of unstable coefficients or inflated standard errors. Primary data from the survey will be complemented by secondary data drawn from prior TAM/TPB studies, industry reports and policy documents, ensuring theoretical coherence and contextual grounding of the empirical model (Silva, 2007; Venkatesh et al., 2003).

Data analysis will proceed using SPSS 25 and SmartPLS 4. SPSS will be used for preliminary descriptive statistics, assessment of data quality, and reliability analysis via Cronbach's alpha (Morgan et al., 2019). SmartPLS 4 will then be employed to conduct PLS-SEM, which is suitable for complex models with multiple latent variables and is widely used in behavioural and technology-adoption research (Hair et al., 2017). The analysis follows two stages. First, the measurement model will be evaluated through indicator loadings (≥0.70), composite reliability and AVE for convergent validity, and Fornell–Larcker plus HTMT criteria for discriminant validity (Fornell & Larcker, 1981; Henseler et al., 2015; Rönkkö & Cho, 2022). Second, the structural model will be assessed by examining collinearity (VIF < 5), path coefficients and their significance via bootstrapping, effect sizes (f^2), and predictive relevance using PLSpredict (Cohen, 1988; Shmueli et al., 2019; Sarstedt et al., 2023). This approach allows simultaneous testing of direct and mediating paths specified in H1–H13, offering rigorous validation of the proposed framework.

The proposed methodology provides a coherent and rigorous empirical strategy for future testing of the conceptual model. This design is consistent with best practice in technology-adoption research and is well aligned with the study's objective to identify and quantify the drivers of advanced technology adoption among eye care practitioners in Malaysia (Creswell & Creswell, 2018; Venkatesh et al., 2003; Hair et al., 2021).

4. CONCLUSION

This study provides a comprehensive explanation of the psychological, social, and cognitive mechanisms shaping Malaysian eye care practitioners' intention to adopt advanced optical technologies, responding to the sector's slow transition toward digital and data-driven practice. The model developed here integrates established behavioural theories to argue that perceived usefulness, perceived ease of use, subjective norm, and perceived behavioural control form the core belief structures that influence both attitude and intention, while positioning attitude as the central mediating force through which these beliefs translate into adoption behaviour. This perspective addresses a significant gap in prior technology-adoption studies, which rarely examine the unique dynamics of optometric practice or the pivotal evaluative role played by attitude in emerging healthcare contexts. By situating technology adoption within the realities of rising clinical demands, digital healthcare priorities, and uneven technological readiness across Malaysian optical services, the paper offers a nuanced and context-sensitive lens for understanding practitioners' decision-making processes. The proposed research design, grounded in quantitative, positivist principles and supported by rigorous measurement and structural modelling techniques, offers a clear and reproducible pathway for future empirical validation. Altogether, the conceptual framework presented here strengthens theoretical understanding, highlights actionable pathways for digital transformation, and provides valuable direction for policymakers and industry stakeholders to enhance practitioners' readiness and motivation to adopt advanced technology, ultimately contributing to more efficient, equitable, and innovative eye care services nationwide.

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